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ABSTRACT

The effectiveness of matching learning styles of community college students to similar teaching strategies in English and mathematics courses was investigated in relation to (1) academic success in courses; (2) attitudes toward the instructor and the course; and (3) attrition rate in courses. Five hypotheses were tested: students would have significantly higher grades; students would have significantly higher Florida State Wide Twelfth Grade Test (FTG) scores; teachers would be evaluated more positively; courses would receive higher ratings; and attrition rates would be lower. Major findings indicated no significant first order interaction effects between learning and teaching styles. However, there was a significant second order interaction effect on grades among learning style, teaching style, and course. Other interactions were found between teaching style and subject on teacher and course evaluations; among the course, teacher and course evaluations, and attrition rate; between learning style and FTG scores; and between sex and course grades. Some implications are that students may have an eclectic approach to learning; that teaching style is one factor to consider in interpreting teacher and course evaluations; and that a direct experience teaching style may reduce class attrition. (MH)

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COMPATIBILITY OF TEACHING STRATEGIES AND LEARNING STYLES AS A DETERMINANT OF ACADEMIC SUCCESS

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COMPATIBILITY OF TEACHING STRATEGIES AND LEARNING STYLES AS A DETERMINANT OF ACADEMIC SUCCESS

Purpose

It was the purpose of this study to investigate the relative effectiveness of matching students' learning styles to similar teaching strategies on: (1) students' academic success in courses, (2) students' attitudes toward the instructor and the course, and (3) students' attrition rates in courses.

Review of the literature

A review of the literature covered the theoretical aspects of learning styles related to: dimensions of cognitive styles, learning style inventories, experimental studies using learner and instructional variables, matching models, and trait-treatment interaction studies. In addition, a review of teacher and course evaluation studies was provided.

Learning styles, according to Cross (1976) are a function of cognitive styles, personality, and ability patterns. These styles differ as a function of the subject matter, nature of the teacher, ability patterns, and modalities or other variations of the instructional process. Messick (1974) has stated essentially the same relationship between cognitive styles and learning styles. Many of the ten dimensions of cognitive styles form the psychological basis for various learning styles.

Since learning style has been shown to be a student characteristic, instruments should be available to profile the students' learning styles. Three diagnostic instruments were used in this experiment: The Canfield and Lafferty Learning Styles Inventory (1974a), Hill's Cognitive Styles Mapping (1971), and Kolb's Learning Style Inventory (1971). Each of these instruments utilize different dimensions for profiling learning

styles. Each has a different theoretical basis. The modality scales of the Canfield and Lafferty LSI was chosen for the research study.

There have been research studies utilizing student learning characteristics and instructional strategies. These studies concluded that students differed in preferred instructional modality (De Nike & Strother, 1975; Glaser, 1966; Levie & Dickie, 1973). Some students, because of their preferred instructional modality, performed academically better in certain learning environments (Tallmadge & Shearer, 1969, 1971). Some studies were not effective in producing significant interaction effects between student characteristics and instructional style on performance variables (Grieve & Davis, 1971; James, 1962).

A review of studies supporting the matching of student characteristics with instructional styles was researched prior to this experiment. Several authors had different matching models based on different psychological theories (Messick, 1974; Messick & Associates, 1976; Salomon, 1972; Snow, 1970). The capitalization match (matching preferred or positive strengths to supportative teaching strategies) was used in this study (Messick, 1974; Messick & Associates, 1976). From the evidence in experimental studies, one would expect students who have been matched using the capitalization model to have higher achievement in courses than students who have not been matched.

The theoretical basis of the expectation of an interaction effect between learning style and teaching style on student achievement measures is reviewed in a discussion of the Trait-Treatment Interaction model. Several studies noted significant differences between student characteristics and instructional environments on dependent achievement measures and evaluations of programs or instruction (Berliner & Cahen, 1973; Hunt &

Hardt, 1967; Lucas, 1970; McLachlan, 1969). However, an equal number of TTI studies have resulted in nonsignificant differences (Berliner & Cashen, 1973; Coop & Brown, 1970; Di Vesta, 1973; Tobias, 1976). The TTI model is questionable as to the predictability of these expected interaction effects. Cronbach (1975) has commented that the results of ATI research have been disappointing. Berliner and Cahen (1973) have concluded that there are many cases where findings of interactions were not confirmed or contrary to the hypotheses. In addition, most of the TTI studies have not been replicated, and when replicated, sometimes produced nonsignificant interaction effects. One needs to be cautious in total acceptance of the TTI model.

Studies involving aspects of teacher and course evaluations were also reviewed. Research indicated that students who were instructed in positive environments based on psychological characteristics often rated their instruction more favorably than those students where such characteristics were not taken into account (Carter, 1969; McKeachie & Associates, 1971; McKeachie & Solomon, 1958; Solomon, Rosenberg & Bezdek, 1964).

Method

An experiment was conducted during the winter term, 1976 at Miami-Dade Community College, North Campus, designed to test the major hypothesis:

I. Students whose learning styles were matched to similar teaching styles will have significantly higher grades in their respective courses than students who were not matched.

II. Students whose learning styles were matched to similar teaching styles will have significantly higher FTG scores than students who were not matched.

III. Students whose learning styles were matched to similar teaching styles will have significantly higher evaluations of teachers than students who were not matched.

IV. Students whose learning styles were matched to similar teaching styles will have significantly higher ratings of courses than students who were not matched.

V. Students whose learning styles were matched to similar teaching styles will have a lower attrition rate than students who were not matched.

The materials used were: The Canfield and Lafferty Learning Styles Inventory (Canfield & Lafferty, 1974a), the Canfield and Canfield Teaching Styles Inventory (Canfield & Canfield, 1975), a posttest achievement measure for English and mathematics (Florida State-Wide Twelfth Grade Achievement Test, Form SRT, 1970), and a teacher and course evaluation devised by McKeachie (1969). All of the procedures and instruments were pilot-tested prior to their utilization in this experiment.

The procedures followed for this experimental study consisted of the following steps:

1. Instructors teaching introductory English (English 120) classes and introductory mathematics classes (Math 120), were asked to participate. Their involvement for the fall term, 1975, was to permit their students to take the LSI and to complete the TSI. The instructors were told that their commitment was to norm a learning styles inventory for possible future use in class registration.

2. Student subjects were assigned a characteristic learning style modality based on the results of the LSI administered during the fall term, 1975. Instructors were assigned to teaching style groups based on the results of the TSI administered during the fall term, 1975.

3. LSI and TSI reliability studies and pilot-testing were conducted independently during the fall term, 1975.

4. Subjects in the final sample (500) were placed into a classroom setting in which one of five teaching styles was used. This placement depended on their LSI score and the course they registered, winter term, 1976.

5. Instructors in the matched experiment (winter term, 1976) were not aware that students had been placed in their classes as a result of their score on the LSI.

6. Students' grade point averages were collected by matching student numbers to the transcript file at Miami-Dade Community College. These data were used as the covariate for dependent achievement measures.

7. At the end of the winter term, 1976, subjects took the FTG test in either English or mathematics and the McKeachie Teacher and Course Evaluation.

8. Letter grades for course performance were collected for all subjects.

Analysis of the results

This experiment design was a 5 X 5 X 2 completely crossed fixed effects factorial configuration. The data were analyzed using analysis of covariance (ANCOVA) and analysis of variance (ANOVA). The independent variables in this design were: learning style, teaching style, and discipline. The dependent variables were: course grade, FTG score, scores on teacher and course evaluation, and attrition rate.

Hypothesis 1

Hypothesis 1 stated that students whose learning styles were matched to similar teaching strategies will have significantly higher grades in their respective courses than students who were not matched.

Letter grades in courses were converted to numeric equivalents (A = 4 pts.; B = 3 pts.; C = 2 pts.; D = 1 pt.; and F = 0 pts). Analysis of covariance, using the cumulative grade point average as the covariate, was employed to test the hypothesis at the .05 level. Table 1 presents the adjusted means and retention of subjects in each cell of the 5 X 5 X 2 design. If the hypothesis were to be accepted, one would expect a significant interaction effect between learning style and teaching style with the matched groups having higher cell means than the other combinations.

The results of the analysis of covariance on the subjects' course grades are presented in Table 2. All of the assumptions for analysis of covariance were met.

The analysis revealed significant differences for the main effect of teaching style ($p<.001$) and for interaction effects of learning style on course grades with respect to teaching styles and course disciplines ($p<.05$). The significant second order interaction effect (L X T X D) may be due to a large sample size and hence a small error term. The hypothesis of a significant interaction effect between learning style and teaching style on course grades was rejected.

A significant difference was detected for the main effect of teaching style on course grades. Students who were in classes presented by an instructor who preferred the reading modality earned higher course grades. Instructor's preference for a reading modality may be a key factor in course performance.

The lowest adjusted means for course grades were found in classes taught by instructors who preferred an iconics teaching strategy. This was true for both English classes and mathematics classes.

Table 1

Adjusted Means of Grades in Course

Learning Styles	Teaching Styles				
	Talking	Reading	Iconics	Direct Experience	Control
English					
Lecture	2.22 (9)	3.44 (9)	1.88 (8)	3.33 (9)	2.44 (9)
Reading	2.60 (10)	3.00 (8)	1.63 (8)	2.78 (9)	3.86 (7)
Iconics	2.86 (7)	3.12 (8)	1.67 (9)	2.89 (9)	2.67 (6)
Direct Experience	3.17 (6)	3.00 (7)	2.33 (9)	3.10 (10)	3.12 (8)
Control	2.63 (8)	3.80 (10)	1.75 (8)	3.10 (10)	3.43 (7)
Mathematics					
Lecture	3.22 (9)	3.67 (6)	2.00 (5)	3.00 (10)	3.63 (8)
Reading	3.10 (10)	3.50 (6)	2.88 (8)	2.67 (9)	3.12 (8)
Iconics	2.89 (9)	3.56 (9)	1.33 (6)	3.25 (8)	2.17 (6)
Direct Experience	3.17 (6)	3.50 (6)	2.00 (5)	2.67 (9)	2.67 (9)
Control	2.89 (9)	2.83 (6)	2.71 (7)	3.12 (8)	2.50 (8)

Note. Numbers in parentheses indicate n in cell.

Table 2

ANCOVA for Grades in Course with Learning Style, Teaching Style, and Discipline as Independent Variables

Source	SS	df	MS	F
Learning Style (L)	4.806	4	1.201	1.471
Teaching Style (T)	49.893	4	12.473	15.269**
Discipline (D)	1.353	1	1.353	1.656
L X T	15.454	16	.966	1.182
L X D	4.275	4	1.069	1.308
T X D	6.307	4	1.577	1.930
L X T X D	21.805	16	1.363	1.668*
Regression	66.296	1	66.296	81.155**
Within	283.468	347	.817	--

*$p < .05$
**$p < .001$

Table 3 presents adjusted mean values of grades in courses at different treatment levels by discipline.

Table 3

Adjusted Means of Course Grades at Different Teaching Style Levels By Discipline

Discipline	Teaching Style	Adjusted Mean Grade
English	Talking	2.550
	Reading	3.358
	Iconics	2.000
	Direct Experience	3.037
	Control	2.987
Mathematics	Talking	2.913
	Reading	3.321
	Iconics	2.533
	Direct Experience	2.992
	Control	2.784

A significant second order interaction effect was also detected in this analysis. Although the F-ratio for this interaction is small, it gives some evidence of a relationship between teaching style, learning style, and discipline on course grades.

There were five possible matches (Learning Style with Teaching Style) in each discipline. By inspection of Table 1, there was one matched combination that produced a higher mean than the other combinations. This was the Group 1 match in mathematics, where student preferred listening and received a lecture approach.

Hypothesis 2

The second hypothesis stated that students whose learning styles were matched to similar teaching styles would have significantly higher Florida State-Wide Twelfth Grade Test (FTG) scores than those students who were not matched. From this hypothesis one would expect a significant interaction effect between learning style and teaching style on FTG scores. In addition, the matches should have higher means than the other combinations.

Raw scores on the FTG test were converted to transformed standard scores (with a mean of 500 and a range of 200-800). Analysis of covariance, using the cumulative grade point average as the covariate, was used to test the hypothesis at the .05 level. Table 4 presents the adjusted means of the FTG scores with the number of subjects in each cell.

If the hypotheses were accepted, one would expect a significant interaction effect between learning style and teaching style, with the matched groups having significantly higher means than the other combinations.

Table 4

Adjusted Means of FTG Scores

Learning Styles	Teaching Styles				
	Talking	Reading	Iconics	Direct Experience	Control
English					
Listening	507.4 (9)	450.6 (9)	499.4 (8)	544.8 (9)	521.6 (9)
Reading	500.5 (10)	410.2 (8)	410.0 (8)	468.3 (9)	531.0 (7)
Iconics	558.0 (7)	439.5 (8)	524.6 (9)	535.4 (9)	488.0 (6)
Direct Experience	571.8 (6)	518.0 (7)	543.2 (9)	516.0 (10)	514.2 (8)
Control	542.0 (8)	471.1 (10)	443.4 (8)	463.0 (10)	538.0 (7)
Mathematics					
Listening	589.8 (9)	513.8 (6)	519.2 (5)	492.9 (10)	544.1 (8)
Reading	501.7 (10)	471.3 (6)	432.0 (8)	471.4 (9)	601.0 (8)
Iconics	511.2 (9)	472.3 (9)	450.8 (6)	502.8 (8)	499.0 (6)
Direct Experience	567.7 (6)	486.0 (6)	524.8 (5)	474.1 (9)	540.2 (9)
Control	502.2 (9)	417.7 (6)	464.0 (7)	451.3 (8)	503.9 (8)

Note. Numbers in parentheses indicate n in cell.

Results of the analysis of covariance on the subjects' FTG scores are presented in Table 5. All of the assumptions of analysis of covariance were met. The analysis revealed significant differences for the main effects of learning style ($p<.05$) and teaching style ($p<.01$). There were no significant interaction effects produced in the analysis. The hypothesis of a significant interaction effect between learning style and teaching style of FTG scores was rejected.

Table 5

ANCOVA for FTG Scores with Learning Style, Teaching Style, and Discipline as Independent Variables

Source	SS	df	MS	F
Learning Style (L)	74857.000	4	18714.250	2.503*
Teaching Style (T)	196223.000	4	49055.750	6.560**
Discipline (D)	41.000	1	41.000	.005
L X T	127259.000	16	7953.688	1.064
L X D	44063.000	4	11015.750	1.473
T X D	20522.000	4	5130.500	.686
L X T X D	86376.000	16	5398.500	.722
Regression	350073.562	1	350073.562	46.815**
Within	2594817.000	347	7747.855	--

*$p<.05$
**$p<.001$

Hypothesis 3

Hypothesis 3 predicted that students whose learning styles were matched to similar teaching styles would rate their instructors significantly higher than those who were not matched. The teacher evaluation scores were calculated from the first half of the McKeachie Teacher and Course Evaluation. Analysis of variance was employed to test the hypothesis at the .05 level. Table 6 shows the means of all the cells with the

Table 6

Means of Teacher Evaluation Scores

Learning Styles	Teaching Styles				
	Talking	Reading	Iconics	Direct Experience	Control
English					
Listening	46.9 (9)	67.7 (9)	55.2 (8)	71.7 (9)	66.0 (9)
Reading	54.5 (10)	67.5 (8)	56.9 (8)	71.1 (9)	69.1 (7)
Iconics	61.6 (7)	66.6 (8)	50.1 (9)	71.6 (9)	69.2 (6)
Direct Experience	63.3 (6)	65.0 (7)	48.0 (9)	72.7 (10)	68.1 (8)
Control	62.6 (8)	65.2 (10)	56.5 (8)	71.6 (10)	69.0 (7)
Mathematics					
Listening	75.0 (9)	74.5 (6)	68.8 (5)	64.3 (10)	62.9 (8)
Reading	71.8 (10)	72.3 (6)	69.8 (8)	60.2 (9)	68.8 (8)
Iconics	74.2 (9)	76.2 (9)	69.0 (6)	65.4 (8)	66.8 (6)
Direct Experience	75.5 (6)	72.8 (6)	66.8 (5)	58.9 (9)	67.4 (9)
Control	71.2 (9)	69.0 (6)	62.1 (7)	64.4 (8)	68.9 (8)

Note. Numbers in parentheses indicate n in cell.

number of subjects in each cell. From the hypothesis, one would expect a significant interaction effect between learning style and teaching style on teacher evaluation scores, and the matched groups having significantly higher means than the other combinations.

The results of the analysis of variance on the subjects' teacher evaluation scores are presented in Table 7. The assumptions of analysis of variance were met.

The analysis revealed significant differences for the main efforts of teaching style ($p<.001$) and discipline ($p<.001$). There was also a significant interaction effect between teaching style and discipline on subjects' teacher evaluation scores. The hypothesis of a significant interaction effect between learning style and teaching style on teacher evaluation scores was rejected.

Table 7

ANOVA for Teacher Evaluation Scores with Learning Styles, Teaching Styles, and Discipline as Independent Variables

Source	SS	df	MS	F
Learning Style (L)	216.758	4	54.190	.570
Teaching Style (T)	4713.320	4	1178.330	12.395*
Discipline (D)	2374.313	1	2374.313	24.975*
L X T	1658.892	16	103.681	1.091
L X D	400.176	4	100.044	1.052
T X D	9289.598	4	2322.399	24.429*
L X T X D	1331.996	16	83.250	.876
Within	33083.121	348	95.066	--

*$p<.001$

Students in the English direct experience group rated their instructors higher than the other groups. Students in the mathematics talking and reading groups rated their instructors higher than the three other

groups. Students in mathematics classes rated their instructors significantly higher (mean of 68.5) than those students in English classes (a mean of 63.4).

There is probably some relationship between course performance and teacher evaluation. When the teaching style cells are collapsed across discipline, the reading group has a higher mean (69.4) than the other groups. That group also had higher adjusted mean course grades than the other teaching style groups.

A review of cell means showed that students in mathematics classes in a lecture approach rated their instructors higher than English students in the lecture approach. Mathematics students also rated instructors using an iconics style higher than English students. Students in English classes using a direct experience approach rated their instructors higher than mathematics students. This approach may be preferred for English students, but not for mathematics students.

Two matches (learning style with teaching style) had higher mean teacher evaluation scores than the other combinations. These occurred in English, Group 4 (direct experience) and in mathematics, Group 5 (control).

Hypothesis 4

Hypothesis 4 predicted that students whose learning styles were matched to similar teaching styles by their LSI scores would rate their courses higher than students who were not matched. Course evaluation scores were calculated from the second half of the McKeachie Teacher and Course Evaluation. Analysis of Variance was used to test the hypothesis at the .05 level. Table 8 shows the cell means of the subjects' rating of courses. From the hypothesis, one would expect a

Table 8

Means of Course Evaluation Scores

Learning Styles	Teaching Styles				
	Talking	Reading	Iconics	Direct Experience	Control
English					
Listening	22.6 (9)	27.2 (9)	27.5 (8)	27.6 (9)	25.8 (9)
Reading	22.3 (10)	24.2 (8)	27.1 (8)	29.9 (9)	27.1 (7)
Iconics	25.1 (7)	24.9 (8)	22.3 (9)	25.8 (9)	26.8 (6)
Direct Experience	26.8 (6)	24.3 (7)	22.9 (9)	29.6 (10)	27.0 (8)
Control	25.4 (8)	28.1 (10)	27.5 (8)	27.1 (10)	25.9 (7)
Mathematics					
Listening	30.7 (9)	33.7 (6)	28.6 (5)	27.9 (10)	28.6 (8)
Reading	29.9 (10)	31.0 (6)	26.8 (8)	27.6 (9)	31.0 (8)
Iconics	28.1 (9)	29.4 (9)	27.3 (6)	27.8 (8)	26.8 (6)
Direct Experience	30.3 (6)	32.0 (6)	26.2 (5)	25.3 (9)	27.7 (9)
Control	30.0 (9)	31.5 (6)	27.3 (7)	26.0 (8)	29.5 (8)

Note. Numbers in parentheses indicate n in cell.

significant interaction effect between learning style and teaching style on course evaluation scores, and the matched groups having significantly higher means than the other combinations.

The results of the analysis of variance on the subjects' course evaluation scores are presented in Table 9. The analysis revealed significant differences for the main effects of teaching style ($p<.05$) and discipline ($p.001$), and a significant interaction effect between teaching style and discipline ($p<.001$) on course evaluation scores. The hypothesis of a significant interaction effect between learning style and teaching style on course evaluation scores was rejected.

Table 9

ANOVA for Course Evaluation Scores with Learning Styles, Teaching Styles, and Discipline as Independent Variables

Source	SS	df	MS	F
Learning Style (L)	105.674	4	26.419	1.474
Teaching Style (T)	195.879	4	48.970	2.732*
Discipline (D)	742.445	1	742.445	41.421**
L X T	314.841	16	19.678	1.098
L X D	62.845	4	15.711	.877
T X D	678.901	4	169.725	9.469**
L X T X D	314.594	16	19.662	1.097
Within	6237.730	348	17.924	--

*$p<.05$
**$p<.001$

Similar to the results of the teacher evaluation analysis, the course evaluation analysis also produced significant differences on course evaluation scores due to the main effects of teaching style and discipline. A first order interaction effect between teaching style and discipline (T X D) was also detected.

Students in the English control group rated their course higher than

the other teaching style groups. Students in the mathematics talking and reading groups rated their courses higher than the other teaching style groups. When teaching style was collapsed across discipline, students in the reading group (with a mean of 28.3) rated their course higher than the other groups.

Mathematics students rated their classes significantly higher (mean of 28.7) than students in English classes (mean of 26.0). The significant first order interaction effect (T X D) shows a relationship exists between preferred instructional modality and discipline on student ratings on a teacher and course evaluation. One match, mathematics Group 1 (listening) had higher mean course evaluation scores than other combinations.

Hypothesis 5

Hypothesis 5 predicted that students whose learning styles were matched to similar teaching styles would have a significantly lower attrition rate (higher retention rate) than those students who were not matched. Table 10 contains the proportion of students retained in each cell at the end of the course. The number of students who finished the winter term, 1976, was 398, 79.9% of the total 500 subjects who were matched at the beginning of the term.

From the hypothesis, one would expect a significant interaction effect between learning style and teaching style on the proportion of students who finished the course. The matched groups would also have a significantly higher proportion than the other combination.

Analysis of variance using an arcsine transformation of the proportion of subjects in each cell was employed to test for significant differences in variance. The assumptions of analysis of variance were met. The results of the analysis are presented in Table 11.

Table 10

Proportion of Students Retained in Classes at End of Winter Term, 1976

Learning Styles	Teaching Styles				
	Talking	Reading	Iconics	Direct Experience	Control
English					
Listening	.9	.9	.8	.9	.9
Reading	1.0	.8	.8	.9	.7
Iconics	.7	.8	.9	.9	.6
Direct Experience	.6	.7	.9	1.0	.8
Control	.8	1.0	.8	1.0	.7
Mathematics					
Listening	.9	.6	.5	1.0	.8
Reading	1.0	.6	.8	.9	.8
Iconics	.9	.9	.6	.8	.6
Direct Experience	.6	.6	.5	.9	.9
Control	.9	.6	.7	.8	.8

Note: Numbers in cells represent proportion of students finishing classes based on original cell size of 10.

The analysis revealed significant differences for the main effects of teaching style ($p < .01$) and discipline ($p < .05$). There were no interaction effects among the independent variables on the proportion of students retained.

The students enrolled in English classes had a higher retention rate ($n = 208$, 52.2%) than students enrolled in mathematics classes

Table 11

ANOVA Using an Arcsine Transformation on Proportion of Subjects Finishing Course with Learning Style, Teaching Style, and Discipline as Independent Variables

Source	SS	df	MS	F
Learning Style (L)	.188	4	.047	.931
Teaching Style (T)	.982	4	.245	4.871**
Discipline (D)	.211	1	.211	4.193*
L X T	1.337	16	.084	1.659
L X D	.118	4	.030	.586
T X D	.426	4	.107	2.116
Residual	.806	16	.050	--

*$p < .05$
**$p < .01$

(n = 190, 47.7%). In the English classes, more students were retained in the direct experience teaching style group (47 out of 50). The mathematics classes had their highest retention in classes taught by a lecture approach (43 out of 50) and a direct experience teaching strategy (44 out of 50). The control group in English had a high attrition rate. This may explain why students in T_5 (control) had high course grades and FTG scores. Poorer students may have dropped out. However, at Miami-Dade Community College, the 20.1% attrition rate for these selected English and mathematics courses was lower than the 28% college-wide attrition rate usually mentioned for similar courses. There were no matched combinations (learning style with teaching style) that had higher retention rates than other combinations.

Findings

The major findings of significance in this study were:

1. There were no significant first order interaction effects between learning style and teaching style on:

    a. grades in respective courses
    b. FTG scores
    c. teacher evaluations
    d. course evaluations
    e. attrition rate

2. There was a significant second order interaction effect of learning style, teaching style, and academic discipline on course grades.

3. There was a significant difference due to the main effect of teaching style on:

    a. grades in respective courses
    b. FTG scores
    c. teacher evaluations
    d. course evaluations
    e. attrition rate

4. There was a significant first order interaction effects between teaching style and discipline on:

    a. teacher evaluations
    b. course evaluations

5. There were significant differences associated with the main effect of discipline on:

    a. teacher evaluations
    b. course evaluations
    c. attrition rate

6. There was a significant difference associated with the main effect of learning style on FTG scores.

7. There was a significant difference associated with the main effect of sex on course grades.

Limitations of the Study

The findings of this study could have been affected by a number of factors. A list of these follows:

1. Selective student mortality within certain groups, particularly

the mathematics group, may have biased the results. The fact that only the good students might have been retained is the basis of this possible bias. Student mortality could have detracted from the significance of the primary effects found on teaching style.

2. The assignment of students to learning style modality groups was based on a self-report instrument. Even though the four scales used on the LSI had good test-retest reliabilities, the validity of the modality section of the LSI could be questioned.

3. The selection of instructors for particular modality groups was also based on a self-report instrument. There was no attempt to control for the inclusion of other modalities of instruction in the curriculum. Even though an instructor might have preferred a particular modality dimension, there was no guarantee that other modalities were not used in that classroom.

4. Most of the students in the sample had more than one class at Miami-Dade Community College besides the experimental one. There was no attempt to control for interaction from other classes or instructors.

5. The number of cells in the design itself was a limitation. The probability of achieving significant interaction effects because of this was reduced.

Conclusions

The following conclusions seem warranted in light of the findings and limitations of the study:

1. The attempt to match student learning styles to teaching styles by using two self-report inventories (LSI and TSI) is not effective. The matching did not produce any significant first order interaction effects between learning styles and teaching style on grades in respective courses, achievement test scores, teacher evaluations, course evaluations, or attrition rate.

2. The trait-treatment interaction model used to predict interaction effects is not effective under the limitations of this study.

3. The capitablization matching model (preferential) is not effective under the limitations of this study. Learning is not enhanced by matching student learning styles to teaching styles.

4. Certain types of teaching styles are universally effective, particularly within one discipline. Other styles, particularly T (Inconics) are not effective in either discipline.

5. The subject matter of the course and type of teaching style affect teacher and course evaluations.

6. The subject matter of courses and type of teaching style affect student attrition rate. A direct experience approach is best to minimize attrition.

7. Female students earn higher course grades in English and mathematics classes than do male students.

Discussion and Interpretation

Although there were no significant first order interaction effects between learning style and teaching style, there were some other significant main effects and interaction effects produced in this study. There was a significant second order interaction effect among learning style, teaching style, and discipline on course grades. T_2 (reading) had higher adjusted mean grades, and consequently higher ratings of instruction and courses. T_3 (iconics) was probably a poor choice as a primary teaching style. Both English and mathematics students in T_3 had lower course grades and FTG scores, and lower ratings of teachers and instructors. The random teaching style group (T_5) had mixed success for some learning style groups. This evidence would support using a variety of teaching approaches, rather than one single style.

There were significant interactions between teaching style and discipline on teacher and course evaluations. Students in mathematics rated their instructors higher than in English classes. Teaching style Group 4 (direct experience) in English classes rated their instructor higher than other groups. Mathematics students rated their instructors who used talking (T_1) and reading (T_2) approaches higher than other groups.

There were significant differences on the primary effects of teaching style and discipline on attrition. Attrition was reduced in classes using a direct experience approach. Perhaps community college students need to experience practical learning situations in order to be motivated.

Another subtle issue is whether instructors should teach students to be adaptors (to adapt to various input stimuli) or to enhance prior cognitive skills by allowing students to select instruction based on learning style preferences. Since this study did not have significant findings supporting the matching concept, the issue of teaching students adaptor techniques needs to be examined.

Finally, the TTI model used in this study needs to be reexamined. Cronbach (1975) has stated:

> The investigator who employs a factorial design can detect some interactions of those conditions he allows to vary, but sizable interactions are likely to be suppressed just because any interaction that does not produce a significant F ratio is treated as nonexistent. Unfortunately, enormous volumes of data are required to pin down higher interactions as significant, unless one is guided by strong prior knowledge. When the facets of the design have more than two levels, the sample size required for establishing complex interactions, at least in instructional research, becomes prohibitive. (p. 124)

The research findings matching learning styles to teaching styles did not produce the desired interaction effects. Some of the F-ratios were almost significant at the .05 level. Cronbach is suggesting that these need to be examined more fully.

Implications

The implications of this study may be drawn from the conclusions. Careful interpretation of the generalizations needs to be exercised. Findings have indicated the following:

1. The trait-treatment interaction model needs to be used

cautiously in predicting significant interaction effects. Since the design of this study was predicated on a TTI model, one might use the number of nonsignificant TTI studies as a basis for the rationale that the TTIs did not materialize in this study.

2. Students may learn in an aclectic manner. That is, instruction probably should be geared to a variety of approaches, not a single "best fit." Since the learning control group (L_5) performed as well as any preferred group (L_1, L_2, L_3, and L_4), learners should be taught using a variety of approaches. There are teaching styles which performed better in English classes, and those which performed better in mathematics classes.

3. Teaching style is a factor which should be considered in interpretation of the results of any teacher and course evaluation. Since a significant interaction effect was detected between teaching style and discipline, care needs to be exercised in reviewing teacher and course evaluations.

4. A direct experience teaching style modality may reduce attrition in classes in community college settings. Evidence was found that the direct experience approach in English classes had the highest retention rate.

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